EXHIBIT 21

Attachment 2

"The perfect is the enemy of the good"

The controversy concerning San Diego County's 2003 Mitigation Strategies for Reducing Wildland Fire Risks report

Richard W. Halsey 2/12/2007
Portion of unpublished manuscript

Fuels management is at the center of controversy over which variables are the most important in fire behavior. If fuel is the limiting factor to fire spread, then it can be assumed that wildfires can be controlled by extending fuel management zones beyond defensible space to include modification of vegetation age and type on a landscape scale. This is one of the methods claimed by some fire plans as being associated with increased structure survival (NCFP 2004). Supporting this assumption is the observation that when flames reach an area with lower fuel loads they have a tendency to "lie down", or reduce intensity (heat released per unit area over time), especially during the evening hours when weather conditions become more favorable to fire suppression (e.g. increased humidity, decreased temperatures). Lower fuel loads are typically encountered when flames reach recently burned areas where vegetation has not had the chance to recover to previous levels, reducing the fire's intensity.

This is the basic assumption behind the Baja-Southern California wildfire model as proposed by Minnich and Chou (1997). They suggest wildfire size is smaller in Baja California because fires have been allowed to burn without active fire suppression efforts, in contrast with areas north of the border, creating a mixed-aged mosaic of vegetation that naturally limits fire spread. This model was cited by the San Diego County task force report referenced above by Supervisor Jacob as evidence for the efficacy of the county's strategy in reducing wildfire risk through vegetation management (SDCBS 2003). Ten of the report's 17 recommendations referred to vegetation management. The other recommendations dealt with policy reviews (4), fire education efforts (2), and fire-safe construction (1). In addressing wildfire behavior in general, the report claimed that, "the preponderance of evidence favors fuel as the limiting factor."

San Diego County's task force report, *"Mitigation Strategies for Reducing Wildland Fire Risks,"* was released one year prior to the 2003 Cedar fire and attracted little public attention until it was referenced by Supervisor Jacob during the San Diego County Board of Supervisors meeting January 7, 2004. Shortly thereafter, several of the scientists cited in the report wrote letters to the board disagreeing with its conclusions and pointing out that their work had been misrepresented (Keeley 2004, Fotheringham 2004, Schoenberg and Peng 2004). In addition, the San Diego Fire Recovery Network (SDFRN), a local group of land management professionals, scientists, and concerned citizens, presented their own letter requesting that the county withdraw the task force report and "replace it

with a new one that comprehensively and objectively reviews all available information" (Spencer et al. 2004).

Specifically the scientists were concerned over what they saw as a bias in favor of demonstrating "that widespread fuel manipulations are the only way to protect property and lives" during wildfires by downplaying the importance of other variables like wind (Keeley 2004). Although the task force report stated that Schoenberg et al. (2003) concluded that fuel was a more significant or "limiting" factor compared to wind, the authors vigorously disagreed. They stated "that wind is a very significant factor in wildfire risk, and at no time did we ever claim that fuel age was a more significant factor. In fact there is to our knowledge no basis whatsoever for such a claim" (Schoenberg and Peng 2004). The report was also seen as "lumping of chaparral and coniferous fire regimes as one phenomenon" instead of "considering the unique characteristics of each" (Fotheringham 2004).

In their evaluation, the SDFRN found the report "woefully inadequate and biased in its treatment of the available scientific information, and flawed in many of its assumptions, its treatment of published data, and its recommendations concerning vegetation management as part of a comprehensive fire-risk reduction strategy" with the apparent intent "to support landscape-scale vegetation management" (Spencer et al. 2004).

When the scientist's letters were released to the media, the county publicly defended the report. Supervisor Jacob responded by saying the errors "don't change the bottom line." Bob Eisele, the county staff member who compiled the task force report, said the report was scientifically sound (Balint 2004), despite strong disagreement from scientists considered experts in fire ecology and management, including some who indicated their work was misrepresented in the report. Robert R. Copper, then the general manager of the county's Land Use and Environment Group, admitted in a meeting on May 25 with SDFRN members that the report was "sloppy and inaccurate" and had no doubt citations had been "fabricated." However, he characterized these inaccuracies as "irrelevant" and that the concerns raised by scientists as "academic BS." Copper ordered all county staff to disassociate themselves from the SDFRN and do what they could to "marginalize" what he labeled as a "radical fringe group".

Despite the serious questions raised about the task force report, the county refused to withdraw it and reconsider the development of a new one. During the May 25 meeting, Copper indicated that the county had to "act in real time, in real space" and "didn't have time for peer review, information input, or workshops" to fine tune county policy. He considered "the perfect is the enemy of the good" (SDFRN member per. comm.).

Although the Board never officially withdrew or corrected the report, it was finally removed from the County's website on August 23, 2004 in response to the ongoing controversy.

References

Balint, K. 2004. Four allege report on fires is flawed. San Diego Union-Tribune. February 13, 2004.

Fotheringham, C.J. 2004. Letter to the San Diego Board of Supervisors.

Keeley, J.E. 2004. Letter to the San Diego Board of Supervisors.

Minnich, R. A., and Y. H. Chou. 1997. Wildland fire patch dynamics in the chaparral of southern California and northern Baja California. International Journal of Wildland Fire 7:221.

NCFP. 2004. Nevada County Fire Plan. Nevada County, California Community Development Agency, Planning Department. August 2004. http://new.mynevadacounty.com/fireplan/

Schoenberg, F.P, and R. Peng. 2004. Letter to the San Diego Board of Supervisors.

Schoenberg, F.P, R. Peng, Z. Huang, and P. Rundel. 2003. Detection of nonlinearities in the dependence of burn area on fuel age and climate variables in Los Angeles County, California. Int. J. Wildand Fire 12: 1-10.

SDCBS. 2003. Mitigation strategies for reducing wildland fire risks. San Diego County Wildland Fire Task Force Findings and Recommendations. San Diego Board of Supervisors. August 13, 2003.

Spencer, W., A. Fege, S. Fleury, B. Goff, M.A. Hawke, J.L. Lincer, J. Bezler, A. Johnson, D. Younkman, M. Klein, G. Smith, J. Peugh. Letter to the San Diego Board of Supervisors.

EXHIBIT 22

Name: **JON E. KEELEY** *http://www.werc.usgs.gov/seki/keeley.asp*

Education: Ph.D. (Botany) University of Georgia, Athens, 1977
B.S & M.S. (Biology) San Diego State University, 1971, 1973

Positions: U.S. Geological Survey, (GS-15 series 0408), 1998–present
University of California, Los Angeles, Adjunct Full Professor, 2001-present
National Science Foundation, Program Director 1997–1998
Occidental College, Biology Professor 1977–1998

Awards: Guggenheim Fellow, 1985–1986
Fellow, Southern California Academy of Sciences, 1994
Honorary Lifetime Member, California Botanical Society, 1998

Selected Publications:

Keeley, J.E., C.J. Fotheringham, and M. Morais. 1999. Reexamining fire suppression impacts on brushland fire regimes. ***Science*** 284:1829-1832.

Keeley, J.E., G. Ne'eman, and C.J. Fotheringham. 1999. Immaturity risk in a fire-dependent pine. ***Journal of Mediterranean Ecology*** 1:41-48.

Keeley, J.E. and C.J. Fotheringham. 2001. The historical role of fire in California shrublands. ***Conservation Biology*** 15:1536-1548.

Keeley, J.E. and C.J. Fotheringham. 2001. History and management of crown-fire ecosystems: A summary and response. ***Conservation Biology*** 15:1561-1567.

Keeley, J.E. 2002. Native American impacts on fire regimes in California coastal ranges. ***Journal of Biogeography*** 29:303-320.

Keeley, J.E. 2002. Fire management of California shrubland landscapes. ***Environmental Management*** 29:395-408.

Keeley, J.E. 2002. Fire and invasives in mediterranean-climate ecosystems of California, pp. 81-94. In T.P. Wilson and K.E.M. Galley (eds) ***Proceedings of the Invasive Species Workshop: The Role of Fire in the Control and Spread of Invasive Species***. Tall Timbers Research Station, Tallahassee, FL.

Keeley, J.E. 2002. Fire management of California shrublands, pp. 175-189. In K.S. Blonksi, M.E. Morales, and T.J. Morales (eds) ***Proceedings of the California's 2001 Wildfire Conference: 10 years After the 1991 East Bay Hills Fire***. University of California Forest Products Laboratory, Technical Report 35.01.462, Richmond, CA.

Keeley, J.E., D. Lubin, and C.J. Fotheringham. 2003. Fire and grazing impacts on plant diversity and invasives in the Sierra Nevada. ***Ecological Applications*** 13:1355-1374.

Keeley, J.E. and C.J. Fotheringham. 2003. Impact of past, present, and future fire regimes on North American Mediterranean shrublands, pp. 218-262. In T.T. Veblen, W.L. Baker, G. Montenegro, and T.W. Swetnam (eds), ***Fire and Climatic Change in Temperate Ecosystems of the Western Americas***. Springer, New York.

Keeley, J.E. and C.J. Fotheringham. 2003. Historical fire regime in southern California. ***Fire Management Today*** 63(1):8-9.

EXHIBIT 22

Name: **JON E. KEELEY** *http://www.werc.usgs.gov/seki/keeley.asp*

Education: Ph.D. (Botany) University of Georgia, Athens, 1977
B.S & M.S. (Biology) San Diego State University, 1971, 1973

Positions: U.S. Geological Survey, (GS-15 series 0408), 1998–present
University of California, Los Angeles, Adjunct Full Professor, 2001-present
National Science Foundation, Program Director 1997–1998
Occidental College, Biology Professor 1977–1998

Awards: Guggenheim Fellow, 1985–1986
Fellow, Southern California Academy of Sciences, 1994
Honorary Lifetime Member, California Botanical Society, 1998

Selected Publications:

Keeley, J.E., C.J. Fotheringham, and M. Morais. 1999. Reexamining fire suppression impacts on brushland fire regimes. ***Science*** 284:1829-1832.

Keeley, J.E., G. Ne'eman, and C.J. Fotheringham. 1999. Immaturity risk in a fire-dependent pine. ***Journal of Mediterranean Ecology*** 1:41-48.

Keeley, J.E. and C.J. Fotheringham. 2001. The historical role of fire in California shrublands. ***Conservation Biology*** 15:1536-1548.

Keeley, J.E. and C.J. Fotheringham. 2001. History and management of crown-fire ecosystems: A summary and response. ***Conservation Biology*** 15:1561-1567.

Keeley, J.E. 2002. Native American impacts on fire regimes in California coastal ranges. ***Journal of Biogeography*** 29:303-320.

Keeley, J.E. 2002. Fire management of California shrubland landscapes. ***Environmental Management*** 29:395-408.

Keeley, J.E. 2002. Fire and invasives in mediterranean-climate ecosystems of California, pp. 81-94. In T.P. Wilson and K.E.M. Galley (eds) ***Proceedings of the Invasive Species Workshop: The Role of Fire in the Control and Spread of Invasive Species***. Tall Timbers Research Station, Tallahassee, FL.

Keeley, J.E. 2002. Fire management of California shrublands, pp. 175-189. In K.S. Blonksi, M.E. Morales, and T.J. Morales (eds) ***Proceedings of the California's 2001 Wildfire Conference: 10 years After the 1991 East Bay Hills Fire***. University of California Forest Products Laboratory, Technical Report 35.01.462, Richmond, CA.

Keeley, J.E., D. Lubin, and C.J. Fotheringham. 2003. Fire and grazing impacts on plant diversity and invasives in the Sierra Nevada. ***Ecological Applications*** 13:1355-1374.

Keeley, J.E. and C.J. Fotheringham. 2003. Impact of past, present, and future fire regimes on North American Mediterranean shrublands, pp. 218-262. In T.T. Veblen, W.L. Baker, G. Montenegro, and T.W. Swetnam (eds), ***Fire and Climatic Change in Temperate Ecosystems of the Western Americas***. Springer, New York.

Keeley, J.E. and C.J. Fotheringham. 2003. Historical fire regime in southern California. ***Fire Management Today*** 63(1):8-9.

EXHIBIT 23

SAN DIEGO FIRE RECOVERY NETWORK

Fostering recovery of our human and natural environment through sound science, improved planning, public education, and community-based action.

5 February 2004

Mr. Walter Ekard
Chief Administrative Officer
County of San Diego
1600 Pacific Highway, Room 209
San Diego, CA 92101

Subject: Independent Science Reviews of San Diego Wildland Task Force Report, Mitigation Strategies for Reducing Wildland Fire Risks (August 2003)

Dear Mr. Ekard:

As the steering committee of the San Diego Fire Recovery Network, we're forwarding to you the attached independent reviews of an important county document entitled, *Mitigation Strategies for Reducing Wildland Fire Risks*, prepared for the County Board of Supervisors, August 13, 2003 (authors anonymous). The importance of this document was highlighted when it was cited by Supervisor Diane Jacob at the January 7, 2004, Board of Supervisors meeting as support for widespread vegetation management actions throughout the county.

We applaud the County's foresight in convening the task force and its intentions in preparing a comprehensive report to address wildland fire risks. Unfortunately, although we agree with many of the report's recommendations, we take strong exception with the report's treatment of the important issue of vegetation management. As supported by the attached reviews by prominent fire scientists, we find the report woefully inadequate and biased in its treatment of the available scientific information, and flawed in many of its assumptions, its treatment of published data, and its recommendations concerning vegetation management as part of a comprehensive fire-risk reduction strategy.

Introduction to San Diego Fire Recovery Network

The San Diego Fire Recovery Network (SDFRN) is a new coalition of land management professionals, scientists, and concerned citizens that formed in the immediate aftermath of the October wildfires. Partners and members in the organization include representatives of numerous governmental and non-governmental organizations with a common interest in protecting human health and safety as well as the quality of this county's valuable wildlands. SDFRN's mission is to foster the post-fire recovery of our human and natural environment through sound science, improved planning, public

education, and community-based actions. We firmly believe that reasoned, science-informed approaches to reducing risks to human life and property will also be widely compatible with maintaining the health of the remarkable fire-adapted ecosystem we live in.

Purpose of Forwarding These Reviews

The attached reviews were authored by four respected scientists who've published widely on fire ecology, fire history, and methods for reducing fire risks in southern California shrublands. The reviews were not solicited by SDFRN, but were submitted to SDFRN because these scientists wanted their concerns to be heard. We want to be absolutely clear that our purpose in forwarding these reviews to the County is not to embarrass or pillory county staff, but to provide information for your consideration and to air concerns about the quality of information being used to justify critical county decisions about life and property. We also offer some recommendations for improving the quality of information being used. SDFRN firmly believes that the Board of Supervisors and other public decision makers wish to base their decisions on the best available information. We are prepared to work with you to help provide this information.

Major Concerns Regarding the August 2003 Task Force Report

The primary concern of the reviewing scientists is that the report is based on an incomplete, biased, and overly simplistic review of scientific information pertaining to the historical fire regime in San Diego County and the relative effects of various fire risk factors here. This inadequate review appears intended to support landscape-scale vegetation management, which would waste scarce financial resources and may actually do more harm than good in preventing future wildfire disasters. The report ignores a number of considerations crucial to preventing structure losses and allocating scarce resources for optimal risk reduction.

The bibliography of the document is substantially incomplete and is biased toward references supporting a view that landscape-scale fuel reductions are required to reduce risks of catastrophic wildfires in San Diego shrublands. Many of the supporting references are newspaper articles or op-ed pieces, leaflets, and other such anecdotal references as opposed to credible, peer-reviewed, scientific papers. This is especially surprising given the large and growing body of relevant scientific literature published in books and prestigious scientific journals (including *Science*, *Ecology*, *Conservation Biology*, *Environmental Management,* and *International Journal of Wildland Fire*). Many of the references in the bibliography cannot even be traced, due to incomplete citations (e.g., missing dates, journal titles, and issue numbers). Others appear to be fabricated (which we hope is just an error rather than intentional). For example, the only reference listed for Dr. Jon Keeley (a leading fire scientist with the U.S. Geological Survey and UCLA whose scientific findings are seriously misrepresented in the report) has a fictitious title and combination of coauthors, despite the fact that Dr. Keeley has published more than a score of peer-reviewed and directly relevant research papers and

book chapters. Key studies by other scientists, including C.J. Fotheringham (UCLA), Max Moritz (Cal Poly San Luis Obispo, recently moved to UC-Berkeley), Jack Cohen (US Forest Service Intermountain Fire Sciences Laboratory), Paul Zedler (formerly SDSU, currently University of Wisconsin), Susan Conard and David Weise (US Forest Service Riverside Fire Laboratory) and many others are totally ignored—while the results of still others, like UCLA statisticians Frederic Schoenberg and Roger Peng, are seriously mischaracterized, as these researchers explain in their attached review.

Overall, the Task Force report does not do a credible job of reviewing the complex issue of vegetation management as it pertains to reducing risks of catastrophic wildfires in shrubland ecosystems. It contains numerous errors of fact and interpretation, it mischaracterizes the conclusions of various studies, it misrepresents important fire-history data, it ignores crucial differences in fire behavior and history among different vegetation communities (e.g., coniferous forest versus coastal sage scrub or chaparral), and it grossly oversimplifies the complexities of how fuels, weather, human fire starts, and vegetation management actions interact to influence fire risks in San Diego County.

Recommendations for Moving Forward

These deficiencies can and must be rectified. We therefore respectfully request that:

1. The County withdraw the report, *Mitigation Strategies for Reducing Wildland Fire Risks*, August 13, 2003, from further consideration as a basis for decisions on wildland management in San Diego County and replace it with a new report that comprehensively and objectively reviews all available information. The new report should address, based on the best available information, the most effective, cost-efficient, and sustainable approaches for reducing risks to human life and property at the wildland-urban interface.
2. In the interest of governmental transparency and accountability, future reports should list authors and task force members by name. The way the existing Task Force report lists agencies and stakeholder organizations that served on the task force (see Attachment II of the Task Force report) seems to imply endorsement by these entities, which is highly misleading. A number of individuals who served on that Task Force have stated that they did not review, approve of, or endorse the content of the report, and that they are deeply troubled by the implied endorsement by their organizations.
3. Any future reports, on this or any other issue that demands synthesis of scientific or technical information, should be subject to independent scientific peer review. Proper peer review of the Task Force report would have revealed significant deficiencies and errors *before* they were used to justify policy positions. It would also have made for a much stronger set of recommendations for how to protect lives and property in San Diego and how best to allocate scarce financial resources.

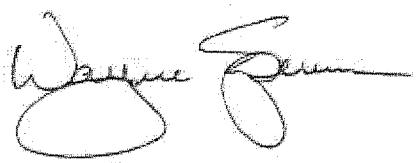
Concluding Remarks

We offer these comments with the most constructive intent possible. We wish to work with the County to improve the quality of information guiding critical policy decisions. Preliminary discussions with key county staff, including the fire marshal, fire services coordinator, and other officials in the Department of Planning and Land Use, indicate they have a sincere desire to consider the best available information and to move forward with reasoned, science-informed plans. We are encouraged by these discussions, and stand ready to help the county in any way you think useful.

In closing we note that SDFRN (with sponsorship from the Cleveland National Forest, San Diego Natural History Museum, The Nature Conservancy, Conservation Biology Institute, Jones and Stokes Associates, the Wildlife Research Institute, and perhaps other organizations) is planning an open fire science workshop for Spring 2004 (tentatively, March 16, 17, 22, or 23), which will focus on the most effective ways of managing vegetation and the human-built environment to reduce risks of catastrophic wildfire associated with our shrubland landscapes. We sincerely hope that county officials will participate in this workshop and help to translate its findings into improved policies.

It is in that spirit that we ask you to consider our comments and recommendations. Please contact Dr. Anne Fege (707-562-9194) or Dr. Wayne Spencer (619-296-0164) with any questions or concerns regarding these matters.

Sincerely,



Wayne D. Spencer, Ph.D.
Senior Conservation Biologist, Conservation Biology Institute
Chair, SDFRN Policy and Planning Committee

Signed on behalf of the Steering Committee of the San Diego Fire Recovery Network:

Anne Fege, Ph.D., Forest Supervisor; Cleveland National Forest; Chair SDFRN
Scott Fleury, Ph.D., Conservation Biologist; Co-chair SDFRN Data Management/GIS Committee
Bruce Goff, Ph.D., Senior Watershed Hydrologist, Sullivan Consulting Group; SDFRN Coordinator
Mary Ann Hawke, Ph.D., San Diego Natural History Museum; Co-chair SDFRN Monitoring and Assessment Committee
Jeffrey L. Lincer, Ph.D., Director of Research, Wildlife Research Institute; Co-chair SDFRN Monitoring and Assessment Committee

Joey Betzler, Ph.D., San Diego Zoological Society; SDFRN Communications Committee
Angela Johnson, URS Corporation; Co-chair SDFRN Data Management/GIS Committee
David Younkman, Chair SDFRN Education and Outreach Committee
Michael Klein, Klein-Edwards Professional Services; Co-chair SDFRN Assessment and Monitoring Committee
Geoffrey Smith, Sierra Club; Chair SDFRN Volunteers Committee
Jim Peugh, Conservation Chair, San Diego Audubon Society

Attachments: Comment letters by Dr. Jon Keeley, Ms. C.J. Fotheringham, Dr. Frederic Schoenberg, and Dr. Roger Peng.

EXHIBIT 25

To the San Diego Fire Recovery Network, 1/26/04

This letter is in response to the San Diego County Wildland Fire Task Force Findings and Recommendations August 13, 2003 report entitled "Mitigation Strategies for Reducing Wildland Fire Risks" as prepared for the San Diego County Board of Supervisors. We were disturbed by the way our research findings were completely mischaracterized in this report on page 8. Not only are the specific statements about our findings completely false, but also, more generally, our research does not support the claims and recommendations of this section of the report.

We turn first to the three sentences on page 8 of the report specifically pertaining to our research, These three sentences contain a host of mistakes. The report states:

> At UCLA, two mathematicians (Peng and Schoenburg) analyzed the Los Angeles Malibu fire regime from a statistical and physics perspective. They were aware of the debate over fuel-driven fires versus wind-driven fires and they concluded that, statistically, fuel was the limiting factor. Their illustration below provides a dramatic illustration of the difference between a landscape shaped with almost no fire suppression activity in Baja California compared to San Diego County's landscape, where highly efficient fire suppression forces are employed.

The first sentence contains some strange minor errors. We are not mathematicians, but statisticians (statistics and mathematics have been separate departments at UCLA since 1998). Schoenberg's name is mis-spelled. We analyzed fires in Los Angeles County, not specifically Malibu. We did not use a physics perspective.

The second sentence contains more serious errors. We never concluded that fuel was a more significant or "limiting" factor compared to wind. We assume the report is referring to either our International Journal of Wildland Fire (IJWF) paper or our Environmetrics paper which is still in review but available as a preprint online (it is difficult to tell which paper since we are not listed in the bibliography). In both of these reports we stated our belief that wind is a very significant factor in wildfire risk, and at no time did we ever claim that fuel age was a more significant factor. In fact there is to our knowledge no basis whatsoever for such a claim. In our IJWF paper we stated that fuel age and wind both seem to be risk factors for monthly area burned, but we never statistically analyzed wind at all, because, as we said in our Discussion, "Wind is known to have a particularly pronounced impact on fire incidence and spread (e.g. Viegas 1998), but wind data is not amenable to the type of analysis performed here.... Hence the analysis of the effect of wind on burn area requires a fundamentally different type of analysis than that employed here." In the Environmetrics paper, we again do not analyze wind at all, and we say in the Conclusions, "The focus on fuel age by no means is meant to underemphasize the importance of other factors in influencing fire risk. These other factors include land use policies, population density, and fire prevention policies, as well as meteorological and topographic variables.... [W]ind is a major factor affecting the size of wildfires. Large catastrophic fires are often driven by high winds and are generally immune to fire suppression."

Regarding the third sentence, the illustration in Fig. 5 is not ours but that of Minnich (1983), and in our Environmetrics paper we state "Despite the fact that Minnich's paper was highly

influential and was used as a support for modern prescribed burning policies, many other works contradict his findings." We then refer to Van Wagner (1978), Johnson and Larsen (1991), and especially Keeley, Fotheringham and Morais (1999), all of whose findings contradict the conclusions of Minnich (1983).

In our research, our main conclusion regarding fuel age and its role in wildfire hazard is simply that wildfire risk does not appear to increase linearly with fuel age, but instead seems to level off after a certain age. In other words, extremely old fuel does not correspond to extremely high burn risk. As we conclude in our IJWF paper, "A possible interpretation is that large wildfires occur primarily when conditions for their ignition are ripe, but that there is little distinction in terms of wildfire risk between conditions that are sufficient for wildfires and those that are extreme. Ours is somewhat similar to the conclusion arrived at by Keeley et al. (1999), who found that large catastrophic wildfires in Southern California 'are not dependent on ancient stands of brush.'"

Thank you for allowing us to clarify our position.

Frederic Paik Schoenberg
Roger Dean Peng

EXHIBIT 26

Reexamining Fire Suppression Impacts on Brushland Fire Regimes

Jon E. Keeley,[1]* C. J. Fotheringham,[2]† Marco Morais[3]‡

California shrubland wildfires are increasingly destructive, and it is widely held that the problem has been intensified by fire suppression, leading to larger, more intense wildfires. However, analysis of the California Statewide Fire History Database shows that, since 1910, fire frequency and area burned have not declined, and fire size has not increased. Fire rotation intervals have declined, and fire season has not changed, implying that fire intensity has not increased. Fire frequency and population density were correlated, and it is suggested that fire suppression plays a critical role in offsetting potential impacts of increased ignitions. Large fires were not dependent on old age classes of fuels, and it is thus unlikely that age class manipulation of fuels can prevent large fires. Expansion of the urban-wildland interface is a key factor in wildland fire destruction.

California shrublands frequently fuel massive high-intensity wildfires that are of increasing concern to resource managers and the public. Despite increased expenditures on fire suppression, each new decade experiences increased loss of property and lives from brushland wildfires (*1*). By the middle of this century, it was suggested that the problem stemmed in large part from the burgeoning population and poor zoning regulations attendant with urban sprawl into the foothills (*2*).

Accepting expanded urbanization as the source of the wildfire problem has profound economic and political implications. An alternative view to emerge in the early 1970s was that the primary problem was tied to the overly successful state and federal fire suppression programs. As a consequence of eliminating fires from the wildland ecosystem, it has been widely held that we have exacerbated the situation by allowing unnatural fuel accumulation (*3*). Thus, when the inevitable fire does come, it is larger and more destructive. A computer model relating fire size to chaparral fuel loading predicted that the prevailing management strategy of fire suppression in California brushlands leads to fewer, but larger and more intense fires (*4*).

A 9-year Landsat imagery record that showed that fires between 5000 and 10,000 ha were slightly more abundant in southern California than in adjacent Baja California (*5*) has been widely cited as support for a link between fire suppression and fire size. On the basis of this study, it has been hypothesized that large wildfires in California shrublands are a modern artifact, due to fire suppression, and that they can be prevented by creation of a mosaic landscape of patches of different ages (*6*). The model is predicated on assertions that, because of fire suppression, (i) the number of fires has declined over time, (ii) fires are substantially larger today than in the past, (iii) contemporary fires burn with greater intensity than in the past, (iv) large fires result from extensive stands of very old age classes, and (v) there has been a decline in area burned, as suggested by some (*3*), but not all (*5*), studies. None of these assertions have been documented.

To investigate historical changes in fire regimes, we used the recently available California Statewide Fire History Database, which includes all records from the California Department of Forestry and U.S. Forest Service and other county records (*7*). We limited our analysis to counties dominated by shrublands with a stand-replacing fire regime: from north to south, Monterey, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego. Records date from the late 19th century for some counties and from at least 1910 for others (*8*).

Collectively, since 1910, there has been a highly significant increase ($r^2 = 0.61$, $P < 0.01$, $n = 9$) in the number of fires per decade. This increase is due largely to southern California counties, which also had significant increases in area burned (Fig. 1) (*9*). In no county was there a significant decline in number of fires or area burned. All counties exhibited significant interdecadal differences in area burned [$P < 0.01$, one-way analysis of variance (ANOVA)]. For most counties, the 1920s and 1970s were high and the 1930s and 1960s low. Collectively, area burned was significantly correlated ($r^2 = 0.71$, $P < 0.01$, $n = 9$) with number of fires, which was also correlated ($r^2 = 0.51$, $P < 0.05$, $n = 9$) with population density (*10*).

All counties reported very large fires from the beginning of record keeping; indeed, one of the largest fires in Los Angeles County was a 24,076-ha fire in 1878 (Fig. 2). During the 20th century, there has been no increase in mean fire size for any county, but four exhibited significant declines (Fig. 2). One contributor to this decline could be a purported inclination by agencies early in the century to not record very small fires (*8*). However, if fires less than 100 ha in size are removed from the data set, there is still a slight downward trend in fire size this century (all counties combined, $r^2 = 0.02$, $P < 0.001$, $n = 2766$). Another factor that could explain a trend toward smaller mean fire size is the increase in human-caused (*11*) ignitions (Fig. 1), coupled with the fact that many are ignited under moderate weather conditions and along roadways, factors contributing to their suppression at a small size (*12*). If we focus just on large fires, greater than 1000 ha, the trend toward smaller fires disappears, but still no county had a significant increase in fire size (ranges: $r^2 = 0.00$ to 0.02, $P > 0.10$ to 0.99, $n = 82$ to 159). The assertion that large wildfires are an artifact of modern fire suppression is not supported.

Contrasting fires after 1950, when fire suppression impacts would be greatest (*13*), with those in and before 1950, we see no significant change in pattern of burning (Fig. 3A); a small percentage of fires account for the bulk of area burned, now and in the past [10% of the fires accounted for 75% (in and before 1950) to 79% (after 1950) of the area burned]. The primary change has been in the proliferation of fires between 10 and 100 ha (Fig. 3B), reflecting both increased ignitions under moderate conditions—that favor suppression—and increased reporting of small fires. In these brushland ecosystems, the frequency of small to medium size fires cannot be used to quantify the risk of large fires (*14*).

Contrasting fire regimes between the first and second halves of this century, we found that fire frequency increased in all but one county (Table 1). The majority of counties exhibited no significant change in mean or median fire size; however, three southern California counties had highly significant declines in mean fire size. Fire rotation intervals, the time required to burn the equivalent

[1]U.S. Geological Survey Biological Resources Division, Western Ecological Research Center, Sequoia–Kings Canyon Field Station, 47050 Generals Highway, Three Rivers, CA 93271–9651, USA. [2]Center for Environmental Analysis–Centers for Research Excellence in Science and Technology, Department of Biology and Microbiology, California State University, Los Angeles, CA 90032, USA. [3]U.S. National Park Service, Santa Monica Mountains National Recreation Area, Thousand Oaks, CA 91360, USA.

*To whom correspondence should be addressed. E-mail: jon_keeley@usgs.gov

†Present address: Organismic Biology, Ecology, and Evolution, University of California, Los Angeles, CA 90095, USA.

‡Present address: Department of Geography, University of California, Santa Barbara, CA 93106, USA.

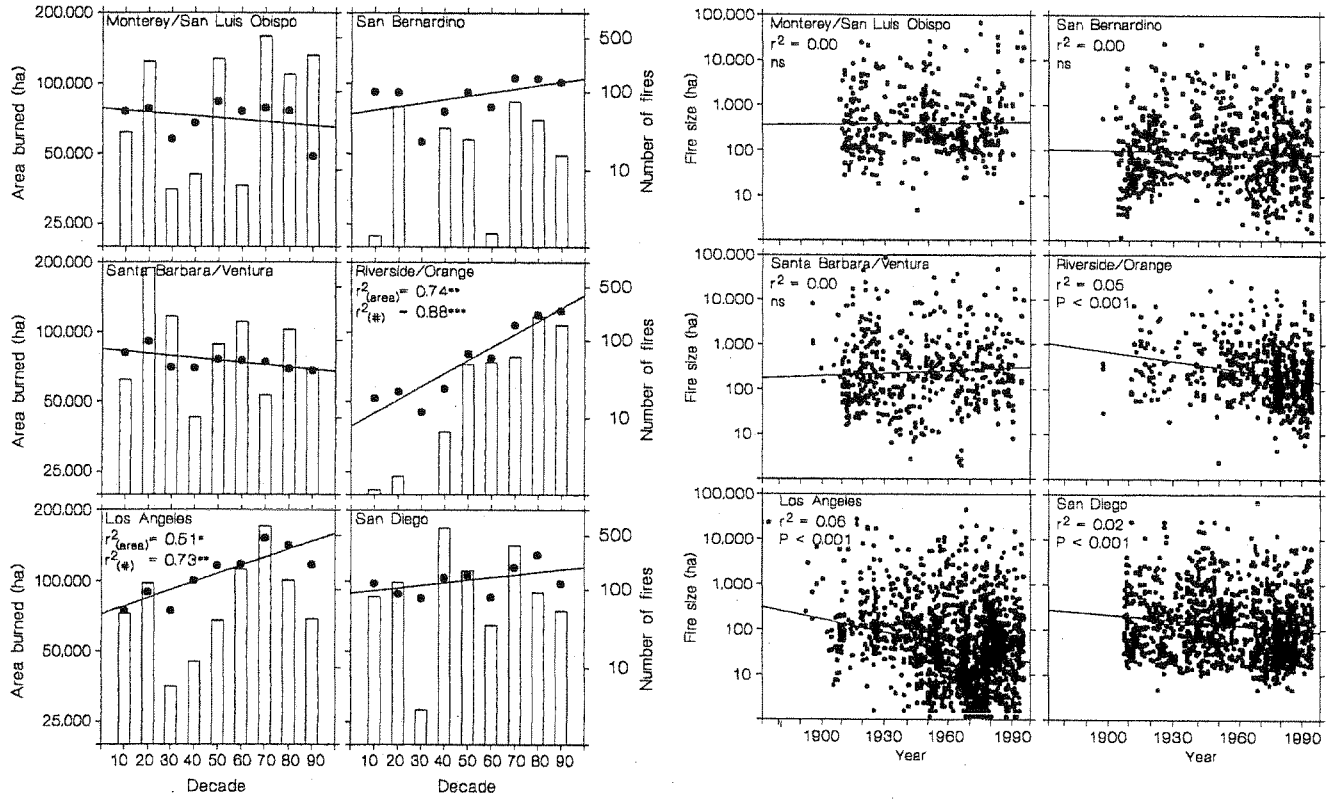


Fig. 1 (left). Area burned (bars) and fire frequency (circles) by decade (1910–1990) for brush-dominated counties in central-coastal and southern California. r^2 is included only when significant: *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$. **Fig. 2 (right).** Magnitude of individual fire size for all records for brush-dominated counties.

Table 1. Brush-covered area as of 1985 and fire statistics for 1910–1950 and 1951–1997 with estimated fire rotation interval (area of brush (22)/average area burned) for California counties. Trends with medians are the same for each county.

County	Brush (10^3 ha)	Number of fires		Mean fire size (ha)			Fire rotation interval (years)	
		Before 1951	After 1950	Before 1951	After 1950	*P*	Before 1951	After 1950
Monterey	358	102	129	1220	1998	>0.32	115	64
San Luis Obispo	250	93	119	1760	2068	>0.68	60	48
Santa Barbara	250	125	61	1622	2341	>0.45	47	81
Ventura	189	143	172	1568	1508	>0.93	121	34
Los Angeles	320	357	1392	827	360	<0.001	44	30
San Bernardino	209	311	544	609	480	>0.33	46	37
Riverside	290	57	613	871	565	<0.01	225	38
Orange	42	25	48	1721	1317	>0.68	36	29
San Diego	365	456	770	939	544	<0.001	35	41

of the total brush area in the county (Table 1), declined in all but two counties (*15*).

These fire rotation intervals do not support the assertion that large fires derive from ancient stands of brush. To investigate the true fire return interval, we used digitized fire maps for the Santa Monica Mountains in Los Angeles and Ventura counties (*16*). Fires in this brush-dominated range have included numerous large catastrophic and costly fires, such as the 1961 Bel Aire Fire or the recent 1993 Green Meadow Fire. Age classes of fuels consumed by all fires exceeding 5000 ha in the past 30 years demonstrate that large fires are not dependent on old classes (Fig. 4). Collectively, there was a significant ($P < 0.05$ with one-way ANOVA, $n = 8$) difference across age classes, with fuels 11 to 20 years old representing 38%, which was more than double the consumption of older age class fuels. Because of the proximity of this range to urban centers, the age classes consumed may not be representative of more remote sites; however, these data demonstrate that large catastrophic wildfires are not dependent on ancient stands of brush and contradict the assertion that young stands less than 20 years of age prevent fire spread (*5*, *6*).

Inferences that fires today are of greater intensity are based on the assertions that fire rotation intervals have increased and there has been a seasonal shift toward autumn burning (*6*). However, rotation intervals have generally declined (Table 1) and September has remained the peak month of burning throughout this century (Fig. 5).

Humans directly affect fire regimes in two ways: They ignite fires and they suppress fires. In brush-covered landscapes of southern and central-coastal California, there is no evidence that fire suppression has altered the natural stand-replacing fire regime in the manner suggested by others (*3*, *5*). This is

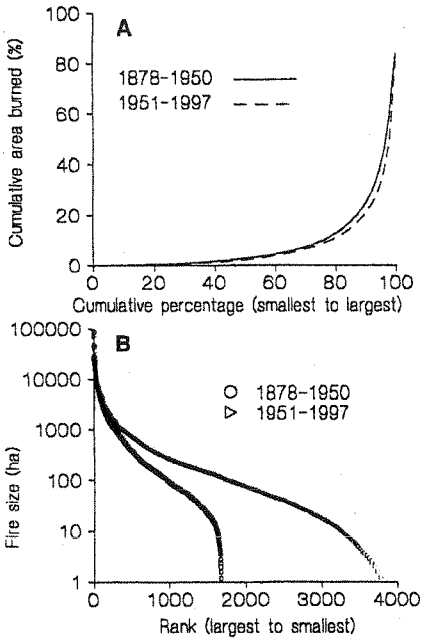


Fig. 3. (**A**) Cumulative area burned and (**B**) fire size distribution, for all counties before and including 1950 and after 1950.

in striking contrast to coniferous forests throughout much of the western United States, where the stand-thinning fire regime has proven amenable to near total fire exclusion, resulting in demonstrably hazardous fuel accumulation and increased potential for catastrophic wildfires (*17*). The primary hazard in brushland ecosystems is the marked increase in fire frequency during the latter half of this century that often results in type conversion to nonnative exotic grasslands (*18*), and fire suppression plays a crucial role in offsetting this impact.

Large catastrophic wildfires in brush-covered regions of California are often driven by high winds, and under these conditions even modern fire suppression techniques are ineffective (*19*). Today, people ignite most of these fires; however, in their absence, lightning storms that typically occur just weeks before the autumn foëhn winds (*11*) would have provided a natural source of ignition. Although fuel structure is an important determining factor in fire behavior, the role of structure diminishes markedly under foëhn winds that can blow at speeds exceeding 100 km/hour and are responsible for the majority of area burned in California brushlands (*19*). Under these conditions, fires readily burn through all age classes of fuels (Fig. 4), and thus, rotational burning programs that attempt to modify vast stretches of chaparral landscape through age class modification are not likely to be effective in stopping these catastrophic fires.

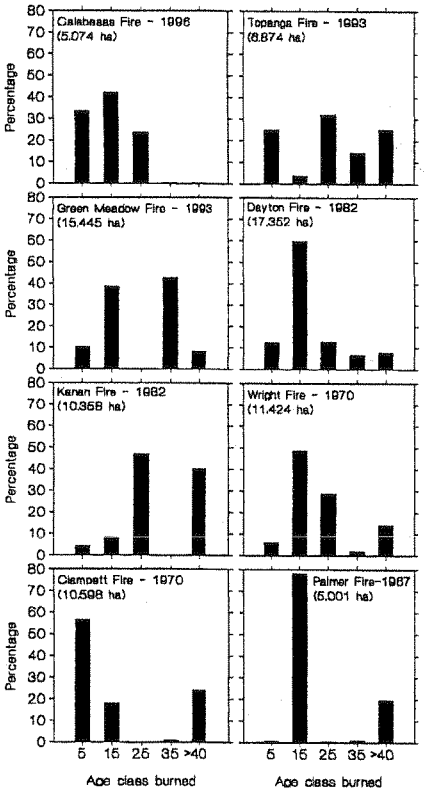


Fig. 4. Age classes burned by all fires over 5000 ha from 1967 to 1996 in the Santa Monica Mountains. Indicated on the abscissa are midpoints of age classes 1 to 10, 11 to 20, 21 to 30, 31 to 40, and over 40 years.

This may come as welcome news to resource managers because the combination of legal restrictions and financial constraints makes large-scale prescribed burning of brushland landscapes unobtainable. Our results support the conclusion that the most effective strategy (*20*) for reducing catastrophic losses from wildfires is to minimize the management effort spent on the bulk of the chaparral landscape and focus on strategic locations. The worst fires predictably follow landscape features, and these patterns can be used to select buffer zones at the urban-wildland interface for more intensive fuel management. However, the urban-wildland interface is so extensive now that even strategically focused intensive management could have enormous ecological impacts. Preference for a rural life-style and the skyrocketing cost of suburban housing in large metropolitan areas continue to expand the urban-wildland interface, and of particular concern is the prediction that rural population will soon exceed urban growth (*21*).

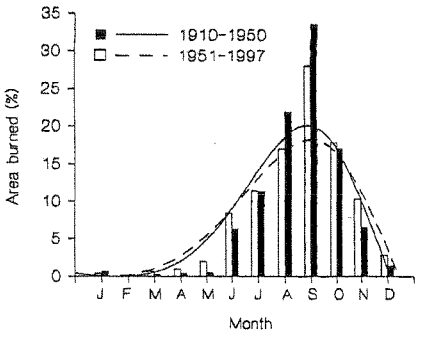


Fig. 5. Area burned by month for 1910–1950 and 1951–1997, for all counties except Riverside and San Bernardino, which were excluded because of incomplete data.

References and Notes

1. T. M. Bonnicksen and R. G. Lee, *J. Environ. Manag.* **8**, 277 (1979). Since 1990, two brushland fires have each exceeded $1 billion in losses (http://frap.cdf.ca.gov/projects/fire_mgmt/fm_main.html).
2. J. A. Zivnuska and K. Arnold [*Calif. Agric.* 4, 8 (1950)] warned "it is known that one of the significant trends in recent population changes has been the increase in number of residences in the flash-fuel types adjacent to primary watersheds."
3. M. Dodge, *Science* **177**, 139 (1972); T. M. Bonnicksen, *Environ. Manag.* **4**, 35 (1980); H. H. Biswell, *Prescribed Burning in California Wildland Vegetation Management* (Univ. of California Press, Berkeley, 1989); S. J. Pyne, *World Fire* (Holt, New York, 1995).
4. R. C. Rothermel and C. W. Philpot, *J. For.* **71**, 640 (1973); C. W. Philpot, *U.S. Forest Serv. Gen. Tech. Rep. WO-3* (1977), pp. 12–16.
5. R. A. Minnich, *Science* **219**, 1287 (1983). This study did not demonstrate any statistical differences, and the mapped comparison (Fig. 1 of that study) was biased by presentation of two massive fires (1932 and 1970) that were outside the Landsat comparison (1972–1980) period and were based on records available only for southern California. More importantly, the conclusion that fire suppression policy is the only difference between southern California and Baja California has never been rigorously demonstrated and ignores landscape, climate, and land-use differences.
6. R. A. Minnich and R. J. Dezzani, in *California Watersheds at the Urban Interface*, J. J. DeVries and S. G. Conard, Eds. (Water Resources Center Report 75, University of California, Davis, 1991), pp. 67–83; R. A. Minnich, in *Brushfires in California Wildlands: Ecology and Resource Management*, J. E. Keeley and T. Scott, Eds. (International Association of Wildlife Fire, Fairfield, WA, 1995), pp. 133–158.
7. California Department of Forestry, Fire and Resource Assessment Program (FRAP), Sacramento, CA. Small fires are not recorded; for example, the U.S. Forest Service records only fires over 16 ha. However, the threshold limit varies with the agency.
8. Fires recorded here burned predominantly in chaparral, which sometimes forms a mosaic with coastal sage scrub, grassland, oak woodland, and coniferous forests. Early in the century, there may be a deficit of small fires because of incomplete reporting, but total area burned is not likely to be affected because small fires are a minor portion and large fires are less likely to have been missed.
9. Adjacent counties were combined for presentation purposes; statistical tests discussed in the text were performed on counties both separate and combined. Data for the 1990 decade were standardized by dividing the average for the first 8 years by 0.8.
10. For population density statistics, see www.census.gov/population/cencounts/ca190090.txt
11. For these counties, natural lightning-ignited fires typically make up less than 5% of all fires [J. E. Keeley, *U.S. Forest Serv. Gen. Tech. Rep. PSW-58* (1982), pp. 431–437].
12. M. A. Moritz, *Ecol. Appl.* **7**, 1252 (1997); P. J. Gee, thesis, University of California, Berkeley (1974).
13. Techniques introduced in the 1950s increased fire suppression potential [S. J. Pyne *et al.*, *Introduction to*

Wildland Fire (Wiley, New York, ed. 2, 1996)]. Additionally, because of low rates of decomposition in these ecosystems, if fire suppression were to result in fuel accumulation, the magnitude of this impact would be cumulative with time and be greatest in the latter half of the century.
14. Compare B. D. Malamud, G. Morein, D. L. Turcotte, *Science* **281**, 1840 (1998).
15. F. W. Davis and D. A. Burrows [in *Patch Dynamics*, S. A. Levin *et al.*, Eds. (Springer-Verlag, New York, 1993), pp. 247–259] predicted that anthropogenically driven landscape fragmentation would increase the fire return interval; their model is sensitive to ignition frequency and most applicable to central-coastal counties, which have not experienced marked increases in fire frequency.
16. Fires over 40 ha from 1925 to 1996; Santa Monica Mountains National Recreation Area, U.S. National Park Service.
17. *Sierra Nevada Ecosystem Project Final Report to Congress* (Centers for Water and Wildlife Resources, University of California, Davis, 1996), vol. II, pp. 1033–1202.
18. J. E. Keeley, in *North American Terrestrial Vegetation*, M. G. Barbour and W. D. Billings, Eds. (Cambridge Univ. Press, Cambridge, 1999), pp. 201–251.
19. C. M. Countryman, *U.S. Forest Serv. Gen. Tech. Rep. PSW-7* (1974).
20. S. G. Conard and D. R. Weise [*Tall Timb. Fire Ecol. Conf. Proc.* **20**, 342 (1998)] found no evidence that fire suppression affected fire size in the San Bernardino National Forest and recommended strategically placed fuel management zones in the wildland areas (that is, fuel breaks) coupled with intensive fire risk management zones to protect the wildland-urban interface.
21. T. D. Bradshaw, *U.S. Forest Serv. Gen. Tech. Rep. PSW-101* (1977), pp. 15–25; J. B. Davis, *Fire Manag. Notes* **50**, 22 (1989).
22. R. Z. Callaham, *California's Shrublands* (Wildlife Resource Center Report 5, University of California, Davis, 1985).
23. We thank C. Gray, M. Moritz, and J. Woods for assistance and J. Agee, M. Borchert, F. Davis, J. Greenlee, C. Skinner, and N. Stephenson for comments.

2 March 1999; accepted 4 May 1999

Positive Feedbacks in the Fire Dynamic of Closed Canopy Tropical Forests

Mark A. Cochrane[1,2,3]* Ane Alencar,[3] Mark D. Schulze,[2,4] Carlos M. Souza Jr.,[2] Daniel C. Nepstad,[1,3] Paul Lefebvre,[1] Eric A. Davidson[1]

The incidence and importance of fire in the Amazon have increased substantially during the past decade, but the effects of this disturbance force are still poorly understood. The forest fire dynamics in two regions of the eastern Amazon were studied. Accidental fires have affected nearly 50 percent of the remaining forests and have caused more deforestation than has intentional clearing in recent years. Forest fires create positive feedbacks in future fire susceptibility, fuel loading, and fire intensity. Unless current land use and fire use practices are changed, fire has the potential to transform large areas of tropical forest into scrub or savanna.

Fire is recognized as a historic but infrequent element of the Amazonian disturbance regime (*1*, *2*). Currently, however, fires in Amazonian forests are frequent because of the accidental spread from nearby pastures and the increased susceptibility of partially logged or damaged forests (*3*–*6*). Here, positive feedbacks associated with accidental forest fires are reported; these constitute a threat to the integrity of a large part of the Amazonian forest.

Field studies were concentrated in the Tailândia region (Fig. 1). Ten 0.5-ha plots (eight fire-affected and two control), spread over 100 km^2, were established in 1996 to study fire impacts on forest structure, biomass, and species composition (*3*). These plots were recensused after the dry season of 1997, during which eight of the plots burned to varying degrees. Fire recurrence, tree mortality, and biomass combustion levels within forests of different burn histories were quantified. In addition, combustible fuel mass was assessed with the planar intersect method (*7*) as adapted by Uhl and Kauffman (*8*, *9*).

We also examined characteristics of fires while they were occurring in four forest types (previously unburned, once-burned, twice-burned, and more than two previous burns) in December 1997. Direct observations of fires were made at widely scattered locations within a 150-km^2 area south of Tailândia. For each observed fire, flame heights and depths (the width of the flaming front) were measured or estimated (*10*). The time the fireline took to move across a known distance was used to calculate the rate of spread and was combined with flame depth data to calculate the average range of flame residence times at a point. Flame height was used as a conservative estimate of total flame length for the calculation of fireline intensity (*11*) because wind and slope were minimal (*12*).

The first fire to enter a forest usually moves slowly along the ground (Table 1) and is similar to a prescribed burn (<50 kW m^{-1}) in intensity (*13*). These fires consume little besides the dry leaf litter, but because of the characteristically thin tree bark [7.3 ± 3.7 mm for >20 cm diameter at breast height (dbh) (*8*)] protecting the cambium tissues, they still kill roughly 95% of the contacted stems >1 cm dbh. Large, thicker barked trees survive. After the fire, a rain of combustible fuels of all sizes falls from the standing dead trees (Table 1) (*14*). Fire damage and windthrow in these thinned forests continue to cause mortality for at least 2 years after the fire (*4*, *15*). Fuel levels rise substantially and the open canopy (50 to 70% cover) allows greater solar heating and air movement to dry out the forest fuels. Previously burned forests thus become susceptible to fire during common dry season weather conditions (*3*).

Previously burned forests were much more likely to burn than were unburned forests in 1997 (Table 1). Burned forests are often adjacent to fire-maintained pasture and agricultural plots and are therefore frequently exposed to sources of ignition. Second fires are faster moving and much more intense. We estimate heat release (*12*) of <7500 kW m^{-2} in first burns but of 75,000 kW m^{-2} or more in subsequent burns. Because of the increased flame depth, the residence time increases despite faster rates of spread, resulting in greater tree mortality. Large trees have little survival advantage during these more intense fires. Fire-induced tree mortality can be modeled as a function of bark thickness and fire residence time (*16*). For the observed fire characteristics and bark thickness distribution (*8*), no more than 45% of trees over 20 cm dbh are susceptible to fire-induced mortality in the initial fires. However, in recurrent fires, up to 98% of the trees become susceptible to fire-induced mortality.

The impacts of recurrent fires are much worse than those of initial fires. Higher mortality results in a very open canopy (10 to 40% cover), large inputs of combustible fuels, and faster drying. During the 1997 fires, substantial amounts of carbon were released to the atmosphere, with combustion reducing onsite biomass by approximately 15, 90, and 140 Mg ha^{-1} in first, second, and recurrent burns, respectively. Invading grasses and weedy vines add highly combustible live fuels to the already

[1]Woods Hole Research Center, Post Office Box 296, Woods Hole, MA 02543, USA. [2]Instituto do Homen e Meio Ambiente da Amazônia (IMAZON), Caixa Postal 1015, Belém, Pará, CEP 66017–000 Brazil. [3]Instituto de Pesquisa Ambiental da Amazônia, Campus do Guamá, UFPa Avenida Augusto Correa S/N, Caixa Postal 8602, Belém, Pará, CEP 66.075–900, Brazil. [4]Department of Biology, Pennsylvania State University, University Park, PA 16802, USA.

*To whom correspondence should be addressed. E-mail: cochrane@whrc.org

EXHIBIT 27

The California Chaparral Institute

...the voice of the chaparral

February 12, 2007

San Diego County Department of Planning and Land Use
Attention: Mario Covic
5201 Ruffin Road , Suite B
San Diego , CA 92123-1666

Dear Mr. Covic,

We are writing to provide you with our comments on the DRAFT Guidelines for Determining Significance and Report Format and Content Requirements for Wildland Fire and Fire Protection.

Although we find the DRAFT does a good job addressing basic ignition resistant building construction, it does not adequately consider the following:

1. Overall firefighter safety
2. Appropriate vegetation management guidelines
3. Negative impact of excessive vegetation "clearance"

In addition, the DRAFT makes the following important errors:

1. Omission of applicable California Environmental Quality Act (CEQA) criteria
2. Inadequate consideration of current scientific research
3. Inaccurate description of the wildfire environment

Finally, we found the County's notification process for the DRAFT's public review process totally inadequate. A significant number of well known, interested parties within the County were never informed of the DRAFT's development or its public review period. We will address this and each of these issues above in greater detail, but first we would like to highlight **two important goals** we feel are critical to establish in any wildland fire management policy.

Goal #1. Improving Firefighter Safety. Five of our firefighting colleagues were killed last year in the Riverside County Esperanza fire while trying to protect a home that should have never been built in the first place (Figure 1).

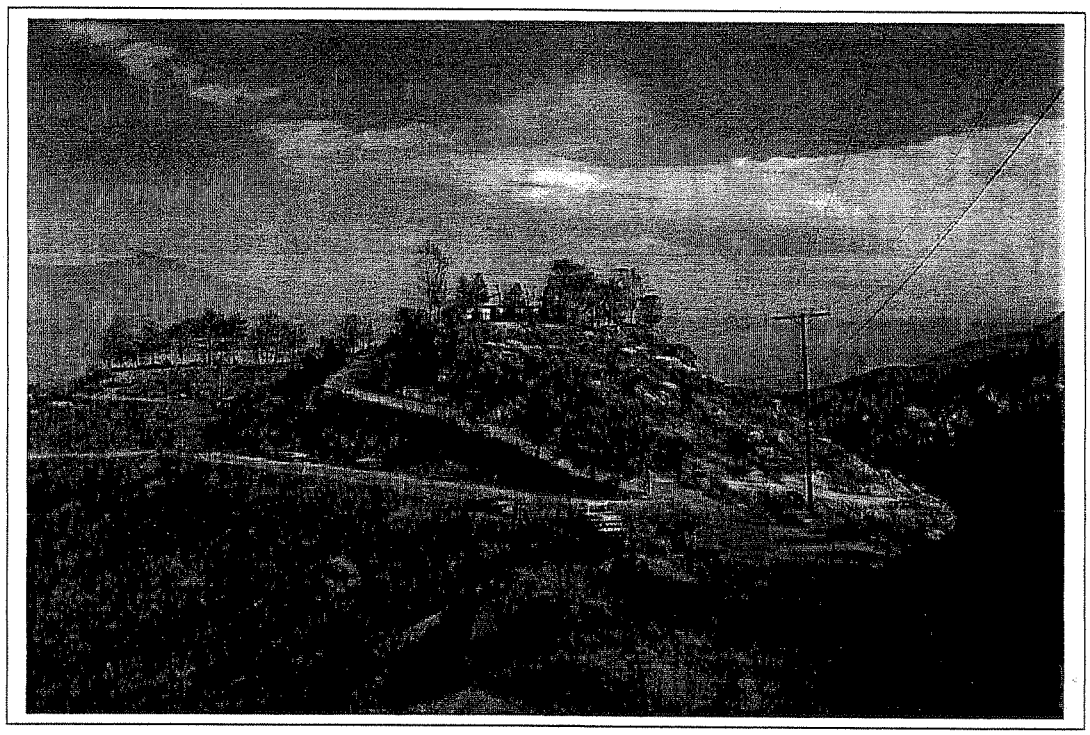


Figure 1. Esperanza fatality site. The fire came up one of the longest and steepest canyons in the San Jacinto Range directly behind and below the hill where the home sits. Structure location and the rapid ignition of the surrounding area facilitated by fine, weedy fuels were significant factors in causing the fatalities.

It is our hope that San Diego County will do all it can to prevent such a tragedy from occurring in our region by requiring that development be both fire-safe and environmentally sustainable in the long term.

Goal #2. Protection of Natural Resources. Since the passage of Public Resource Code 4291, requiring 100 feet of vegetation clearance around structures within high fire-risk zones, a significant number of homeowners have unnecessarily stripped away large areas of native habitat from their property (Figure 2). This action is frequently in response to threatening abatement orders issued by private contractors (such as Fire Protection Services) hired by fire districts to help enforce "clearance" regulations. With an obvious conflict of interest, *these same contractors perform the required "clearance" work specified in the abatement notices they themselves issue,* often ignoring California Department of Forestry and Fire Protection (CDF) guidelines. See attachment #1 for an example of such an occurrence.

It is our hope that San Diego County will adopt clear vegetation management guidelines that respect the need to protect valuable natural resources.

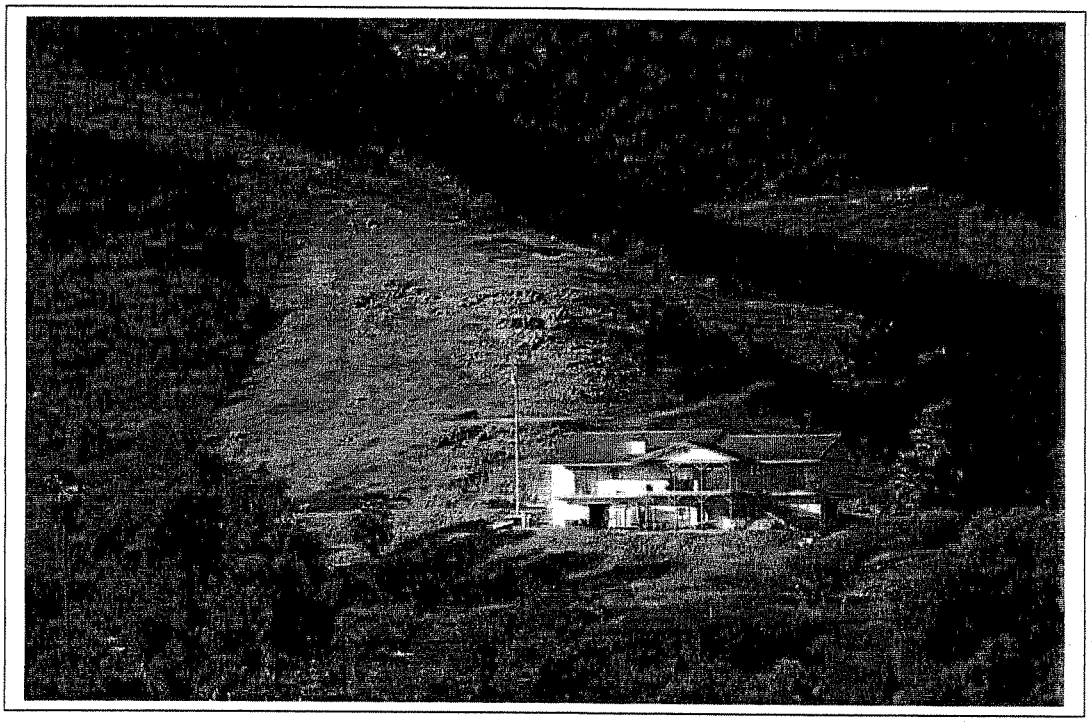


Figure 2. Excessive vegetation clearance in north San Diego County. Although the greatest fire danger is down slope, this owner chose to completely eliminate all ground cover on the property regardless of the long term costs in doing so.

In order to create a successful wildfire management/risk-reduction strategy, both firefighter safety and resource protection need to be addressed in a sustainable and balanced manner. It is our hope the following analysis and suggestions on the DRAFT Guidelines will assist San Diego County in doing so.

Resource damage

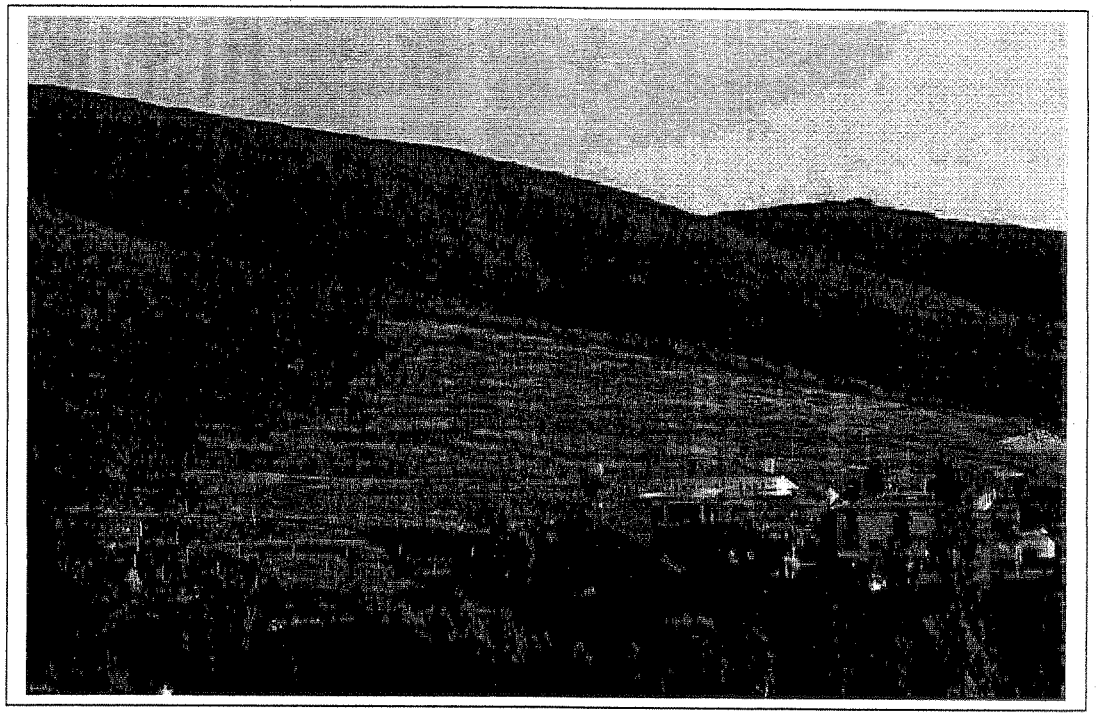
As shown in Figure 2, the footprint of inappropriate vegetation clearing can have a dramatic impact on natural resources. This not only destroys valuable native habitat, but increases erosion, allows the invasion of fine, highly flammable weedy fuels, and requires expensive maintenance year after year (Figures 3 and 4).

There is limited natural open space in San Diego County. As the population grows, the demand for such space will only increase. Expanding the footprint of development by requiring unnecessary clearance will eliminate thousands of acres of habitat. As a consequence the decision to clear native landscapes must be determined by an accurate cost/benefit analysis not personal perspectives (p. 16).

The DRAFT does a good job addressing ignition-resistant building construction, but then deals with vegetation management issues in isolation (p. 15, 28, Tables 1-3). County wildfire guidelines treat all new fire-safe structures as if they still have unboxed eaves,

flammable siding and wood shake-shingle roofing. With ignition-resistive construction, most of the wildfire-property loss risks are greatly reduced, and there will be limited benefits from requiring wide fuel management zones more than 100 feet.

Instead of rejecting a proposed development situated in an unsafe fire corridor, DRAFT guidelines will likely result in excessive vegetation clearances to satisfy wildland fire safety requirements. **Clearances in excess of 400 feet may be required under the DRAFT's guidelines** through the inappropriate use of BEHAVE fire models (p. 21 and Table 2).



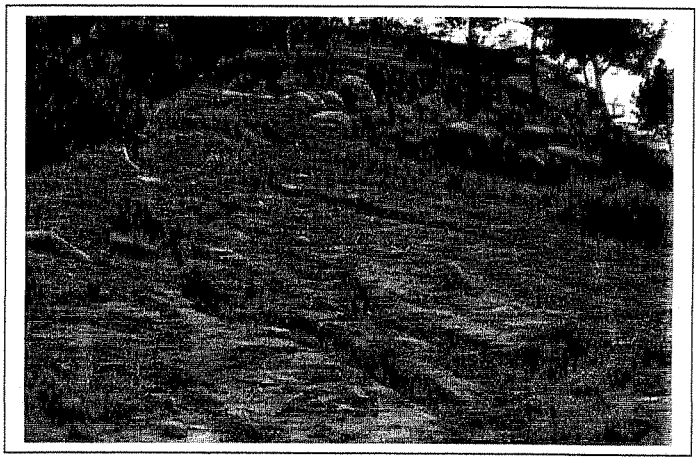


Figure 3 above. Excessive "clearance" of native chaparral above a home. Owner has created dangerous levels of fine, flammable fuels, increasing the chance of an ignition. SD County.

Figure 4 left. The impact of erosion after owner denuded the slope of native vegetation below his home. SD County.

Although planning for the worst-case scenario is an important component in fire planning, it is also essential to consider all the variables involved when determining appropriate vegetation management strategies. A one-size-fits-all approach may be the simplest in the short run to administer, but it will ultimately lead to significant long term costs not accounted for in the DRAFT guidelines.

In addition to resource damage and expensive yearly maintenance, cleared areas can increase what they are supposedly designed to reduce, fire risk. Cleared areas are always invaded by annual weeds that greatly change the probability of an ignition. While they make for defensible space **they also increase the risk of a fire occurring**. Thus, any clearance project needs to factor that into the cost/benefit analysis.

Increased firefighter risk

One of the common factors in firefighter fatalities is the presence of fine, highly-flammable grassy fuels. Based on preliminary research, such fine fuels were a significant factor in causing the death of the five USFS firefighters in the 2006 Esperanza fire (Kempter and Halsey, unpub). These fuels dry quickly and can be responsible for spontaneous ignition, creating massive amounts of heat instantly. See Figure 3.

Requiring excessive clearances around properties increases the chance such fine fuels will accumulate. This is due to soil disturbance associated with clearance activities and the complete removal of the native shrub canopy. While it is hoped that property owners will be responsible and remove fine fuels on a regular basis, such an expectation is not realistic. Excessive maintenance costs prevent 100% compliance and there will never be enough inspectors to enforce the regulations.

Knowing how to maintain appropriate vegetative cover to prevent fine fuel accumulation is critical. **Mandating vegetation management to reduce fire risk without clear guidelines will set the stage for future firefighter fatalities.**

Denial of permits for firefighter death traps

Something all firefighters know, the public does not fully understand, and developers often are allowed to ignore, **is that some homes are indefensible despite reasonable defensible space and fire-resistant construction efforts.** The DRAFT properly recognizes this by stating that a project would be "recommended for denial based on the inability to comply with existing fire regulation" (p. 15). However, based on past practices, denial of a development due to fire risk is highly unlikely. What is more likely is that a developer will be required to damage large amounts of native habitat within or along the project's boundaries. Potentially more damaging is that "offsite areas may be included" beyond the development's boundaries to create a fuel management zone (p. 28).

An alternative to excessive clearance requirements is to include wildfire buffer zones around the development itself rather than compromising surrounding native landscapes. Shea Homes designed such a community in Riverside County in which homes are separated from the Cleveland National Forest by the development's golf course. See attachment #3 for a letter to Shea Homes congratulating them on their fire-safe design.

At some point San Diego County fire management/land use officials must begin to acknowledge and codify that **there are certain areas where the costs to mitigate fire risk in order to allow development are too great.** During the 2003 Cedar fire, several homes located at the point where the flames crossed Interstate 8 and entered Harbison Canyon were swallowed up by "giant claws of fire" and destroyed within a matter of minutes (Halsey unpub.). This is what occurred during the Esperanza incident (Figure 1). These homes were death traps for anyone, especially firefighters trying to defend them. The DRAFT fails to properly address this situation.

CEQA regulations

A glaring error in the DRAFT is the omission of applicable CEQA criteria such as biological resources (destruction of habitat, damage to natural resources, etc.) and geological hazards (slope stability, erosion, increased run-off, etc.). This problem is likely the result of minimal outside review and input during the DRAFT's development.

In addition, the "Determination of Significance" section in the DRAFT's Report Format needs to include an additional item incorporating the County's Resource Protection Ordinance, applying it to the analysis of vegetation modification in the defensible space zone.

Wildland fire planning documents are not just about fire, but how we plan on modifying the total fire environment. This involves significant biological, social, recreational, and cultural issues, all of which need to be properly addressed by the entire community. Without proper input, the natural resources of our region will be seriously compromised (Figure 5).

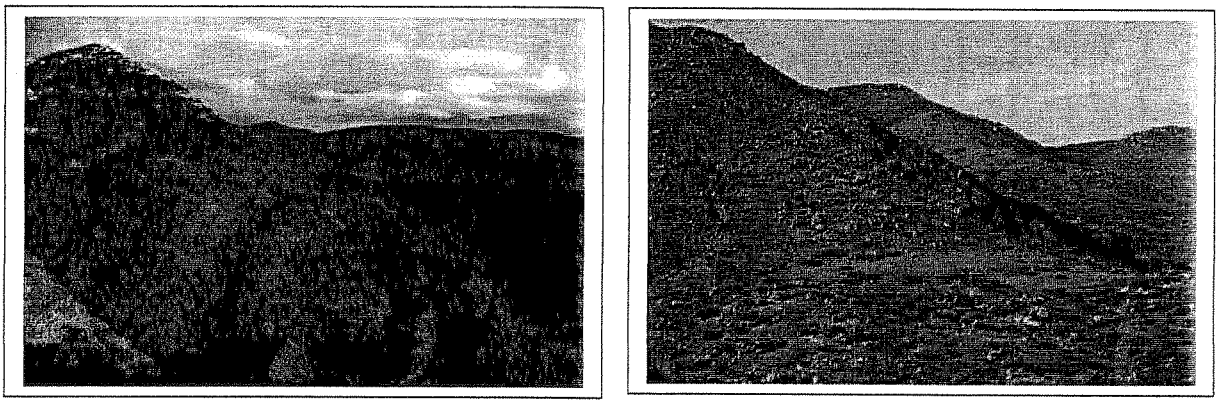


Figure 5. Healthy, native chaparral on left. Right photo shows a compromised landscape that has been type-converted due to high fire frequency and poor land use practices.

Misunderstanding of San Diego County's natural environment

Despite the fact that San Diego County's dominant plant community is chaparral (1,003,441 acres – Fried et al. 2004) the DRAFT ignores this fact and emphasizes conifer forests in both its description of the Wildland Urban Interface (WUI) and the Wildfire Environment (p.2). This is troubling since fire behavior and ecological processes differ dramatically in chaparral vs. forested systems. Confusing the two leads to inappropriate fire-risk reduction plans.

The DRAFT states that "past fire management practices and natural resource restrictions have contributed to a build-up of highly flammable fuels in the County..." (p. 2). This is a frequently repeated opinion that has little basis in fact. Claiming that natural resource protection has helped to create a fire problem in San Diego County is not consistent with current research and appears to be the result of limited editorial review. The best public policy is crafted by multiple talents with divergent views. Drafting a document such as this in a collaborative manner with all interested parties would prevent such errors in judgment.

A. Forests vs. Chaparral. While fire suppression may be blamed for fuel build-up in southwestern ponderosa pine forests (Allen et al. 2002) it is not the case for the California's shrubland communities (Keeley and Fotheringham 2001).

B. Chaparral Ecology. The DRAFT continues its misunderstanding of chaparral ecology by stating that *"fire suppression activities have resulted in older stands of native fuel, with a greater percentage dead, combustible material. When these old stands do burn, especially in a Santa Ana wind event, they burn far hotter and more destructively"* (p. 14).

This implies that the main wildfire-risk in the County is the "un-natural" age of the vegetation. Again, recent research has shown that this is not the case (Moritz et al. 2004). In addition, multiple investigations have found similar 30% dead to living ratios across a range of 20 to 60 year-old chaparral stands without any relation to age (Payssen and Cohen 1990, Regelbruggee 2000).

Chaparral stands are not a homogenous mass of shrubbery, but represent a dynamic range of variations. Broad assumptions about dead to live fuel ratios will only lead to faulty vegetation management activities. With a steadily growing population making more demands on wild open space, we must protect what remains with careful, scientifically-based decision making.

C. Past Errors Repeated. The DRAFT's indication that old fuels can be modified by *"prescribed burning in a patch-quilt pattern conducted in the winter season"* (p. 14) appears to be pulled directly from the County's highly criticized 2003 *Mitigation Strategies for Reducing Wildland Fire Risks* report. This report misquoted scientists in an apparent attempt to justify the use of landscape-scale vegetation treatments. The report was removed from distribution and the County's

website because of its **factual errors and inaccurate conclusions**. See attachment #2 for a synopsis of the controversy.

While such artificial treatments can certainly accomplish the goal of dramatically changing the natural landscape, they also endanger the continued existence of native ecosystems through type-conversion, increase the spread of invasive weeds, and are not cost-effective methods to properly deal with wildland fire risk (Le Fer and Parker 2005, Keeley 2004, Keeley et al. 2004).

It was hoped by the scientific community that this issue had been properly understood by the County, but its reappearance in the DRAFT indicates this is unfortunately not the case.

Poor utilization of available science

There has been little research conducted on the variables responsible for fire spread and ignition of structures during brushland wildfires in Southern California. In lieu of this, personal estimates based on anecdotal evidence are frequently used to determine clearance distances regardless of the flammability of the structure. This is not acceptable public policy.

An extensive effort by the Center for Fire Research and Outreach, based at UC Berkeley's College of Natural Resources, has been made to coordinate what we know about wildland fire risk and practical applications of that knowledge. This should have been one of the first places the County contacted to gather relevant information. At the very minimum the County should have notified the Center of its DRAFT. Neither was done.

Fire scientists who work directly with the County, such as those with the University of California's Cooperative Extension office, were also unaware of the DRAFT's existence.

The best published research available on structure ignition and its relationship to defensible space has been done by USFS scientist Jack Cohen (1999, 2000). Although Cohen's work has been conducted in forested systems, it can at least provide a rough bench mark for San Diego County. Cohen's studies have suggested that **vegetation clearance beyond 100 feet frequently has diminishing returns** and that it is often more cost effective to concentrate on building design than excessive landscape clearing. Although the DRAFT cites Cohen in its reference section, it is unclear where his work is actually used in the document regarding defensible space. It would be helpful in future County publications if references are footnoted or cited within the text itself.

When private fire management consultants have cited Cohen's work in county fire plans they have been told by County officials to include a disclaimer that the County Planning Department does not support Cohen's conclusions. We are puzzled by this apparent rejection of sound data and hope it is not a model for how County fire management officials view science.

Collaboration

Sharing best practices from informed practitioners

It was with great disappointment that many of us within the San Diego fire community discovered this DRAFT document by accident on February 8, 2007, the day before the public review period was originally scheduled to end.

It is my understanding that the County sent notices via email and regular mail to a number of agencies and individuals regarding the availability of the DRAFT. We are not aware of who was on the mailing list, but it did not include most of those who have been intimately involved in trying to shape a balanced approach to wildfire risk in San Diego County since the 2003 firestorm.

Excluded from notification included:

- those who played an active part in the **San Diego Fire Recovery Network**
- numerous fire scientists who have been involved with County wildland fire issues
- Center for Fire Research and Outreach, UC Berkeley
- scientists and advisors with the University of California Cooperative Extension office
- major San Diego County fire consultants
- local conservation groups like the California Native Plant Society, Audubon, and the Sierra Club

Not only should have these groups and individuals been notified about the DRAFT, but for an optimal plan they should have been consulted in the document's development. The County Planning and Land Use Department was well aware of their past involvement and interest.

It is the government's responsibility to engage and collaborate with all parties who have a stake or interest in the development of a particular public policy. It is counterproductive to create public policy within a vacuum because it creates both inadequate results and unnecessary tensions within the community. Policy created without appropriate public input or based on biased information is doomed to failure, and in this case may create conditions that do the exact opposite of the policy's intentions (i.e. reduce wildfire risk). Unfortunately, a lot of damage can occur before the policy is finally corrected.

While most other municipalities and counties go to great lengths to include all interested parties, San Diego County seems to operate on a less collaborative model. In the past, various County officials have expressed the desire to exclude particular individuals from the process due to their criticism of prior fire management documents. This was particularly true for anyone associated with the **San Diego Fire Recovery Network**, a broadly based community group composed of hundreds of scientists, land managers, government agency representatives, and private citizens. See attachment # 2 for details.

We find it difficult to understand why the County appears to be continuing this unproductive approach.

We ask once again for San Diego County to engage in a fully transparent, collaborative approach when developing land use planning and fire management policies. Steps that can be taken now to implement such a change include:

1. Create a broad-based stakeholder group to assist in the development of a County wide wildland fire management plan. This group must include representatives from all interested parties including firefighters, conservationists, land conservancies, fire scientists, developers, insurers, government agencies, among others.

2. Include all interested individuals and agencies in the notification process (including those associated with the San Diego Fire Recovery Network) for County wildland fire management policy reviews. We would be more than happy to provide a contact list to update the County's request for notification records.

3. Conduct open, public meetings for the review and discussion of fire plans/guidelines developed by the wildland fire stakeholder group or any other planning entity.

Wildland fire policy is not just about the reduction of fire risk. It involves how the entire community adapts to the fire-prone environment in which we live. Consequently, the entire community must be *allowed to be* involved. It is the only way to create successful government, preserve our region's natural resources, and protect the lives of private citizens and the firefighters we depend on.

Sincerely,

Richard W. Halsey
Director
California Chaparral Institute
www.californiachaparral.org

Timothy Ingalsbee, Ph.D.
Executive Director
Firefighters United for Safety, Ethics and Ecology
info@fusee.org

Attachments

1. Homeowner experiences with abatement order
2. Controversy concerning the 2003 *Mitigation Strategies for Reducing Wildland Fire Risks* report
3. Letter to Shea Homes congratulating them on appropriate, fire-safe community design

References

Allen, C.D, M.S. Savage, D.A.Falk, K.F. Suckling, T.W. Swetnam, T. Schulke, P.B. Stacey, P. Morgan, M. Hoffman, and J. T. Klingel. Ecological restoration of southwestern ponderosa pine ecosystems: a broad perspective. Ecological Applications 12: 1418-1433.

Cohen, J.D. 1999. Reducing the wildland fire threat to homes: where and how much? USDA Forest Service Gen. Tech. Report PSW-GTR-173, pp 189-195.

Cohen, J.D. 2000. Preventing disaster: home ignitability in the wildland-urban interface. Journal of Forestry 98: 15-21Cohen, J. and J. Saveland. 1997. Structure ignition assessment can help reduce fire damages in the W-UI. Fire Mgt. Notes 57:19-23.

Fried, J.S., C.L. Bosinger, and D. Beardsley. 2004. Chaparral in Southern and Central Coastal California in the Mid-1990's: Area, Ownership, Condition, and Change. USFS Resource Bulletin PNW-RB-240.

Keeley, J.E. 2004. Invasive plants and fire management in California Mediterranean-climate ecosystems. In M. Arianoutsou (ed) 10th MEDECOS – International Conference on Ecology, Conservation and Management, Rhodes Island, Greece, electronic, no page numbers.

Keeley, J.E. and C.J. Fotheringham. 2001. Historic fire regime in Southern California shrublands. Conservation Biology 15: 1536-1548.

Keeley, J. E., C. J. Fotheringham, and M. Moritz. 2004. Lessons from the 2003 wildfires in southern California. Journal of Forestry 103: 26-31.

Le Fer, D. and V.T. Parker. 2005. The effect of seasonality of burn and seed germination in chaparral: the role of soil moisture. Madrono 52: 166-174. http://userwww.sfsu.edu/~parker/parkerweb/pages/publications.html

Moritz, M.A., J.E. Keeley, E.A. Johnson, and A.A. Schaffner. 2004. Testing a basic assumption of shrubland fire management: how important is fuel age? Frontiers in Ecology and the Environment 2: 67-72.

Payson, T.E., and J.D. Cohen. 1990. Chamise chaparral dead fuel fraction is not reliably predicted by age. Western Journal of Forestry 5:127-131.

Regelbrugge, J.C. 2000. Role of prescribed burning in the management of chaparral ecosystems in southern California. In J.E. Keeley, M.B. Keeley, and C.J. Fotheringham (eds.) 2nd Interface between Ecology and Land Development in California. Sacramento: US Geological Survey Open-File Rep. 00-02, pp. 19-26.

EXHIBIT 28

Urban Design Element

As a part of a package of edits addressing wildfires, Policy UD-A.3.p added as follows:

p. Design structures to be fire-resistant. Incorporate fire-resistant exterior building materials and architectural design features to minimize the risk of structure damage or loss due to wildfires.

Section UD-F edits, related to public art, as follows:

UD-F.1. Integrate ~~Incorporate~~ public art and cultural amenities that respond to the nature and context of ~~correspond, in complementary or contrasting way~~ their surroundings. Consider the unique qualities nature of the community and the special character of the area in the development of public art and programming for cultural amenities. ~~artworks.~~

Change UD-F.1.b: Use public art and cultural amenities to improve the design and public support for public infrastructure projects."

Eliminate UD-F.1.c. *(This idea is effectively captured in UD-F.1.f.)*

Edit UD-F.1.g.: "Encourage involvement of recognized community planning groups and other community stakeholders in the decision-making process regarding public art and cultural amenities."

Replace "cultural activities" appears, with "cultural amenities": 4th sentence in UD-F "Discussion", UD-F.1.b, UD-F.1.d, UD-F.2.c, UD-F.2.d, UD-F.3.a.

Eliminate UD-F.2.b. *(This idea is effectively captured in UD-F.2.c.)*

Please change UD-F.2.c: "Support public art and cultural amenities that explore, reflect and respond to the diverse facets of historic and contemporary San Diego life.

Edit UD-F.3.c: "Encourage the use of public art in...."

Edit UD-F.3.g: "Encourage temporary public artworks to create a dynamic and...."

As recommended by the LU&H Technical Advisory Committee, an edit to Policy UD-C.1.e regarding mixed use zoning is underway to clarify that existing, as well as new Land Development Code regulations may be used to implement mixed use policies.

Additional edits recommended by the Planning Commission are underway, as indicated in Attachment 12.

Public Facilities, Services, and Safety Element

As a part of a package of edits addressing wildfires, text added to Section D. Fire Rescue as follows:

Due to climate, topography, and native vegetation, the City of San Diego is subject to both wildland and urban fires. In 2003 and 2007, the City of San Diego experienced wildland fires that resulted in the loss of structures and significant burned acreage.

The extended droughts characteristic of the region's Mediterranean climate and increasingly severe dry periods associated with global warming results in large areas of dry, native vegetation that provides fuel for wildland fires. The most critical times of year for wildland fires are late summer and fall when Santa Ana winds bring hot, dry desert air into the region. The air temperature quickly dries vegetation, thereby increasing the amount of natural fuel. The Santa Ana conditions create wind-driven fires such as 2003 and 2007 wildfires, which require more fire-rescue assets than the City has available.

Development pressures increase the threat of wildland fire on human populations and property as development is located adjacent to areas of natural vegetation. The City contains over 900 linear miles of wildland/urban interface due to established development along the open space areas and canyons. In 2005, the brush management regulations were updated to require 100 foot defensible space between structures and native wildlands. See Conservation Element, Policy CE-B.6 on the management of the urban/wildland interface and Urban Design, Policy UD-A.3.p on the design of structures adjacent to open space.

The San Diego-Fire Rescue Department is responsible for the preparation, maintenance, and execution of Fire Preparedness and Management Plans and participates in multi-jurisdictional disaster preparedness efforts (see Public Facilities, Services and Safety Element Section P, Disaster Preparedness). In the event of a large wildfire within or threatening City limits, they could be assisted by the California Department of Forestry, Federal Fire Department, or other local fire department jurisdictions.

Background in Section P. Disaster Preparedness revised as follows:

The countywide plan identifies risks posed by natural and manmade disasters including fires, earthquakes, landslides, and floods and ways to minimize damage from those disasters.

Figure PF-1 was revised (see attached).
Northern area of the University Planning Area was changed to a Facilities Benefit Assessment area. (The southern area of the University Planning Area is a Development Impact Fee area).

PF-H.3.a

a. Plan for a water supply and emergency reserves to meet peak load demand during a natural disaster such as a fire or earthquake.

PF-I.3.h

h. Use closed and inactive landfill sites for public benefits, such as provision of energy from waste generated methane, creation of wildlife habitat upon proper remediation or other land uses such as parks determined to be appropriate.

Section P First Goal revised as follows:

- A city and region that, through diligent planning, organizing, and training is able to prevent, respond to, and recover from ~~prepared for~~ man-made and natural disasters.

PF-I.2.

f. Reduce and recycle Construction and Demolition (C&D) debris to the extent feasible. Strive for recycling of 100 percent of inert C&D materials and a minimum of 50 percent by weight of all other material ~~by weight~~.

Additional edits recommended by the Planning Commission are underway, as indicated in Attachment 12.

Conservation Element

Policy edits as follows:

CE-B.6 Provide an appropriate defensible space between open space and urban areas through the management of brush and use of transitional landscaping.

CE-A.9. Reuse building materials, use materials that have recycled content, or use materials that are derived from sustainable or rapidly renewable sources to the extent possible, through factors including~~such as~~:

- Scheduling time for deconstruction and recycling activities to take place during project demolition and construction phases.
- Using life cycle costing in decision-making for materials and construction techniques. Life cycle costing analyzes the costs and benefits over the life of a particular product, technology, or system; ~~and~~
- Removing code obstacles to using recycled materials in buildings and for construction; and
- Implementing effective economic incentives to recycle construction and demolition debris (see also PF-I.2)

CE-A.11.f

Strive to incorporate existing mature trees and native vegetation into site designs.

CE-A.11 - added sub-policy "i" as follows:

i. Encourage the use of high efficiency irrigation technology, and recycled site water to reduce the use of potable water for irrigation. Use recycled water to meet the needs of development projects to the maximum extent feasible.

CE-A.13 Regularly monitor and update the City's Climate Protection Action Plan.

a. Inventory greenhouse gas emissions, including emissions for the City of San Diego community-at-large and for the City of San Diego as an organization.

b. Identify actions and programs designed to reduce the climate change impacts caused by the community-at-large and the City of San Diego as an organization.

CE-E.2.f

Avoid development of areas particularly susceptible to erosion and sediment loss (e.g., steep slopes) and, where impacts are unavoidable, enforce regulations that minimize their impacts.

EXHIBIT 29

EDMUND G. BROWN JR.
Attorney General

State of California
DEPARTMENT OF JUSTICE

1515 CLAY STREET, 20TH FLOOR
OAKLAND, CA 94612-0550
Telephone: 510-622-2145
Facsimile: 510-622-2270
E-Mail: sandra.goldberg@doj.ca.gov

February 27, 2008

By Regular and Electronic Mail

Nancy Bragado, General Plan Program Manager
City Planning & Community Investment
202 C Street, MS 4A
San Diego, CA 92101

RE: General Plan Update, Project No. 104496

Dear Nancy:

Thank you for sending me the most recent revisions to the General Plan Conservation Element. The new language of CE-A.5 a. states: "Develop sustainable building standards for new and significant remodels of residential and commercial buildings to maximize energy efficiency, and strive for net zero energy consumption by 2020 for new buildings." We appreciate that this includes standards to maximize energy efficiency for significant remodels of existing buildings. The goal of net zero energy consumption for new buildings is also laudable.

As you know, we also encouraged including a policy to require energy efficiency improvements to commercial buildings at the time of sale. The provisions of CE-A.5 are broad enough to encompass this and we hope that the City will adopt such a provision in the future. The California Energy Commission "strongly supports capturing all cost-effective efficiency savings potential" and notes that efforts to achieve this will require "legislation or regulations requiring energy improvements at the time of a building's sale." 2007 Integrated Energy Policy Report, December 2007, p. 103 and p.5. Such a provision would be similar to the City Plumbing Retrofit Ordinance (Municipal Code §147.04) which requires: "Before change of ownership, the transferor of any existing structure shall replace any existing plumbing fixture with a water-conserving plumbing fixture." (§147.0404(a)) and also: "Upon bathroom alteration, the responsible person shall replace any existing plumbing fixture in the bathroom being altered with a water-conserving plumbing fixture." (§147.0405).

We believe that the changes you are recommending to the General Plan have helped to make the policies stronger and ensure that greenhouse gas emissions will be reduced (rather than to just encourage reductions). We appreciate your efforts to address this critically important issue.

Sincerely,

SANDRA GOLDBERG
Deputy Attorney General

For EDMUND G. BROWN JR.
Attorney General

cc: Shirley R. Edwards, Chief Deputy City Attorney